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Mixing and dissipation of internal wave energy on a shelf slope

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On the shelf slope north of Scotland the rate of turbulent kinetic energy (TKE) dissipation, calculated from the scale of density overturns, is $6 \pm 1 \times 10^{-7}$ W kg^{-1}. Using a standard mixing efficiency, this dissipation rate is equivalent to a diapycnal diffusivity of 10^{-3} m^2 s^{-1}, two orders of magnitude larger than typical open ocean background values. The rate of TKE dissipation cannot be fully explained by local shear and strain measurements so we invoke a far-field source of energy, supplied in the form of internal waves, to drive mixing over the slope. The across-slope internal tide energy flux is 130 W m^{-1}, with 103 ± 20 W m^{-1} contained in the pycnocline. Trains of internal solitary waves are observed, propagating up the slope along the pycnocline, with energy fluxes of 42 ± 10 W m^{-1}. From these fluxes a bulk TKE dissipation rate between 5 and 8×10^{-7} W kg^{-1} is inferred by assuming all the internal wave energy is dissipated in the $\sim$ 4.5 km horizontal distance that the pycnocline intersects the slope, comparable to the dissipation rate calculated from density overturns. Energy for mixing, supplied by the internal wave field, is radiated upwards and downwards where the pycnocline intersects the slope. This emphasises the role of internal waves in the transfer of tidal energy, not just into the deep ocean, but around topography.